

CLAIMS

What is claimed is:

- 5           1.     A method of providing version control within a fault tolerant system comprising:
- a) invoking a boot sequence of a first controller that is coupled to a non-volatile storage system;
- b) during said boot sequence, comparing a preferred application version  
10 with a stored application version stored within a memory of said first controller;
- c) provided said stored application version is different from said preferred application version, storing said preferred application version into said memory; and
- d) provided said stored application version is the same as said preferred  
15 application version, causing said first controller to execute said stored application version.
2.     A method as described in Claim 1 wherein said preferred application version is stored in said non-volatile storage system and wherein c) comprises  
20 causing said first controller to re-boot.
3.     A method as described in Claim 1 wherein said memory is a programmable non-volatile memory.

4. A method as described in Claim 1 wherein said memory is a flash memory.

5. A method as described in Claim 1 wherein said non-volatile storage system is a disk array storage system.

6. A method as described in Claim 1 wherein said preferred application version provides an interface between a host server and said non-volatile storage system.

7. A method as described in Claim 1 wherein said invoking a boot sequence comprises:

a1) executing a first level wake-up boot sequence;

a2) during said first level boot sequence, checking two application versions that are associated with a second level boot sequence and selecting a most recent valid version; and

a3) executing said most recent valid version as said second level boot sequence.

8. A method as described in Claim 7 wherein said invoking a boot sequence further comprises:

a4) during said second level boot sequence, checking two application versions that are associated with a third level boot sequence and selecting a most recent valid version; and

a5) executing said most recent valid version as said third level boot sequence.

9. A method as described in Claim 8 wherein said second level boot  
5 sequence performs hardware discovery and base level diagnostics.

10. A method as described in Claim 1 wherein said fault tolerant system further comprises a second controller coupled to said non-volatile storage system and wherein said method further comprises:

10 invoking a boot sequence of said second controller while said first controller is operational;

during said boot sequence of said second controller, comparing said preferred application version with a stored application version that is stored within a memory of said second controller;

15 provided said stored application version of said second controller is different from said preferred application version, storing said preferred application version into said memory of said second controller and causing said second controller to re-boot; and

20 provided said stored application version of said second controller is the same as said preferred application version, causing said second controller to execute said stored application version.

11. A method of providing version control within a fault tolerant system comprising a non-volatile storage system coupled to first and second controllers,  
25 said method comprising the steps of:

a) while said second controller is operational, invoking a boot sequence of said first controller wherein said non-volatile storage system contains a preferred application version that is associated with said non-volatile storage system;

b) during said boot sequence, comparing said preferred application version  
5 with a stored application version stored within a memory of said first controller;

c) provided said stored application version is different from said preferred application version, storing said preferred application version into said memory; and

d) provided said stored application version is the same as said preferred  
10 application version, causing said first controller to execute said stored application version.

12. A method as described in Claim 11 wherein c) comprises causing  
said first controller to re-boot.

13. A method as described in Claim 11 wherein said memory is a flash  
15 memory.

14. A method as described in Claim 11 wherein said preferred  
20 application version provides an interface between a host server and said non-volatile storage system.

15. A method as described in Claim 11 wherein said step a) comprises  
the steps of:

a1) executing a first level wake-up boot sequence;

a2) during said first level boot sequence, checking two application versions that are associated with a second level boot sequence and selecting a most recent valid version; and

5 a3) executing said most recent valid version as said second level boot sequence.

16. A method as described in Claim 15 wherein said step a) further comprises the steps of:

10 a4) during said second level boot sequence, checking two application versions that are associated with a third level boot sequence and selecting a most recent valid version; and

a5) executing said most recent valid version as said third level boot sequence.

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17. A method as described in Claim 16 wherein said second level boot sequence performs hardware discovery and base level diagnostics.

18. A method as described in Claim 11 wherein said method further comprises the steps of:

invoking a boot sequence of said second controller while said first controller is operational;

during said boot sequence of said second controller, comparing said preferred application version with a stored application version stored within a  
25 memory of said second controller;

provided said stored application version of said second controller is different from said preferred application version, storing said preferred application version into said memory of said second controller and causing said second controller to re-boot; and

5 provided said stored application version of said second controller is the same as said preferred application version, causing said second controller to execute said stored application version.

19. A fault tolerant system comprising:

10 a non-volatile storage system containing a preferred application version;  
a first controller coupled to said non-volatile storage system and comprising a first memory containing an application version; and

a redundant second controller coupled to said non-volatile storage system and comprising a second memory containing an application version, wherein said  
15 first controller, when booting, compares said preferred application version with said application version of said first memory;

wherein said first controller, provided said application version of said first memory is different from said preferred application version, stores said preferred application version into said first memory and re-boots; and

20 wherein said first controller, provided said application version of said first memory, is the same as said preferred application version, executes said application version of said first memory.

20. A fault tolerant system as described in Claim 19 wherein:

said second controller, when booting, compares said preferred application version with said application version of said second memory;

wherein said second controller, provided said application version of said second memory is different from said preferred application version, stores said preferred application version into said second memory and re-boots; and

wherein said second controller, provided said application version of said second memory, is the same as said preferred application version, executes said application version of said second memory.

21. A fault tolerant system as described in Claim 19 wherein said first and second memories are each programmable non-volatile memory.

22. A fault tolerant system as described in Claim 19 wherein said first and second memories are each flash memory.

23. A fault tolerant system as described in Claim 19 wherein said preferred application version is associated with said non-volatile storage system.

24. A fault tolerant system as described in Claim 19 wherein said non-volatile storage system is a disk array.

25. A method of providing version control within a storage system comprising:

a) invoking a boot sequence of a first controller that is coupled to a storage device having stored thereon a first application version;

b) during said boot sequence, comparing the first application version to a second application version stored in a memory of said first controller; and

c) if the first application version is different from the second application version, reconciling the first controller and the storage device such that the same application version is stored on both the memory of the first controller and the storage device.

26. The method of Claim 25 wherein said reconciling comprises storing the first application version into the memory of the first controller.

27. The method of Claim 25 wherein said reconciling comprises storing the second application version into the storage device.

28. The method of Claim 25 wherein said reconciling comprises:  
if the first application version is more recent than the second application, storing the first application version into the memory of the first controller; and  
if the second application version is more recent than the first application, storing the second application version into the storage device.

29. The method of Claim 25 wherein c) comprises rebooting the first controller.

30. A fault tolerant system providing version control comprising:  
a storage system having stored thereon a first application version;



a first controller coupled to said storage system and for invoking a boot sequence during which said first controller compares the first application version to a second application version stored in a memory of said first controller; and

5        said first controller, if the first application version is different from the second application version, reconciles between the storage device such that the same application version is stored on both the memory of the first controller and the storage device.

10        31.    The system of Claim 30 wherein said first controller performs reconciling by storing the first application version into the memory of the first controller.

15        32.    The system of Claim 30 wherein said first controller performs reconciling by storing the second application version into the storage system.

33.    The system of Claim 30 wherein first controller performs reconciling by:

if the first application version is more recent than the second application, storing the first application version into the memory of the first controller; and

20        if the second application version is more recent than the first application, storing the second application version into the storage device.

34.    A method of providing version control within a fault tolerant system comprising:

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- a) invoking a boot sequence of a first controller coupled to a storage system;
  - b) during said boot sequence, comparing a preferred application version with a stored application version stored within a memory of said first controller;
  - c) provided said stored application version is different from said preferred application version, storing said preferred application version into said memory;
  - d) provided said stored application version is the same as said preferred application version, causing said first controller to execute said stored application version;
  - e) invoking a boot sequence of a second controller coupled to said storage system while said first controller is operational;
  - f) during said boot sequence of said second controller, comparing said preferred application version with a stored application version that is stored within a memory of said second controller;
  - g) provided said stored application version of said second controller is different from said preferred application version, storing said preferred application version into said memory of said second controller.

35. A method as described in Claim 34 further comprising:

- h) provided said stored application version of said second controller is the same as said preferred application version, causing said second controller to execute said stored application version.

36. A method as described in Claim 34 wherein said preferred application version is stored in said storage system.